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INCREASED INSULATION

BUILDING ENVELOPE IMPROVEMENT

The U.S. Environmental Protection Agency's **ENERGY STAR® Program** promotes the use of high-efficiency technologies and equipment. ENERGY STAR labeled homes use at least 30% less energy than homes built to meet the national Model Energy Code while maintaining or improving indoor air quality. These fact sheets are designed to help consumers learn more about the energy-efficient improvements to their ENERGY STAR labeled homes.

Proper insulation is a key element for a more comfortable and energy efficient home. It is important to have a continuous boundary of insulation between the conditioned, indoor spaces and the unconditioned, outdoor spaces. This boundary is referred to as the "building envelope" and consists of the walls, floor, and ceiling or roof. Low insulation levels and gaps or voids in the insulation materials can provide paths through which heat and air can easily flow into or out of the residence. Care must be taken to shape the insulation material around piping and electrical work without compressing it.

Building codes typically require a minimum insulation level for each component of the building envelope. These levels vary from state to state depending on climate conditions. In most climates, it is both easy and cost effective to increase these insulation levels beyond the minimum code requirements (see Figure 1 below for recommended levels).

Insulation materials available include batt-type, loose fill, rigid foam panels, and spray-type. Insulation materials are rated according to their ability to resist heat flow. This thermal resistance rating is commonly known as an "R-value". The higher the R-value of a material, the better its ability to resist heat flow. The reciprocal of the R-value is the U-value, which characterizes the rate of heat loss.

If moist air gets inside the building envelope and condenses on cold surfaces, it can cause damage to the insulation and building structure. In cold climates it is recommended to keep the insulation and envelope cavities dry by applying a vapor retarder or low permeability paint to the warm side of the envelope.

Look for ENERGY STAR labeled homes to include insulation levels that exceed code requirements with materials carefully installed to ensure rated performance.

FIGURE 1: COST EFFECTIVE INSULATION R-VALUES[a]

If you live in a climate that is…	and your heating system[b] is a…	then insulate to these levels in the…			
		ceiling	wood frame walls[c]	floor	basement/ crawl space walls[d]
Warm with cooling and minimal heating requirements (i.e., FL & HI;coastal CA; southeast TX;southern LA, AR, MS, AL & GA).	gas/oil or heat pump	R-22 to R-38	R-11 to R-15	R-11 to R-13	R-11 to R-19
	electric resistance	R-38 to R-49	R-11 to R-22	R-13 to R-25	R-11 to R-19
Mixed with moderate heating and cooling requirements (i.e.,VA, WV, KY, MO, NE, OK, OR, WA & ID; southern IN, KS, NM & AZ;northern LA, AR, MS, AL & GA; inland CA & western NV).	gas/oil or heat pump	R-38	R-11 to R-22	R-13 to R-25	R-11 to R-19
	electric resistance	R-49	R-11 to R-28	R-25	R-11 to R-19
Cold (i.e., PA, NY, New England, northern Midwest, Great Lakes area, mountainous areas (e.g., CO, WY, UT, etc.)).	gas/oil	R-38 to R-49	R-11 to R-22	R-25	R-11 to R-19
	heat pump or electric	R-49	R-11 to R-28	R-25	R-11 to R-19

a. Adapted from the U.S. Department of Energy 1997 Insulation Fact Sheet.

b. Insulation is also effective at reducing cooling bills. These levels assume that you have electric air-conditioning.

c. R-Values are for insulation only (not whole wall) and may be achieved through a combination of cavity (batt, loose fill or spray) and rigid board materials.

d. Do not insulate crawl space walls if crawl space is wet or ventilated with outdoor air.

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RESOURCES

The Consumer Guide to Home Energy Savings (Wilson and Morrill) 5th edition, 1996, available from the American Council for an Energy Efficient Economy at 510-549-9914

Homemade Money (Heede and the staff of RMI), 1995, available from the Rocky Mountain Institute at 970-927-3851

The following fact sheet is available by calling the U.S. Environmental Protection Agency's toll-free ENERGY STAR Hotline at 1-888-STAR-YES (1-888-782-7937): ***Air Sealing***.

Insulation fact sheet available from the Energy Efficiency and Renewable Energy Clearinghouse (EREC), P.O. Box 3048, Merrifield, VA 22116, 1-800-DOE-EREC (1-800-363-3732)

Consumer Guide to Insulation (Jeanne Byrne), September/October 1996 issue of *Home Energy Magazine*. Reprints available from the publisher at 510-524-5405 or http://www.homeenergy.org

BENEFITS

Increased insulation can provide many benefits including:

Improved comfort. Increased insulation reduces conductive heat losses and gains resulting in warmer interior surfaces in the winter and cooler interior surfaces in the summer. Approximately 40 percent of our physical comfort in homes is due to radiant heat exchange between our bodies and the surrounding interior surfaces. Increased insulation reduces this radiant heat exchange and minimizes temperature differences between rooms, thus maintaining a more consistent level of comfort throughout a house.

Improved indoor air quality. When insulation levels are increased and materials properly installed, there are fewer gaps and voids through which unconditioned air can leak into a house. This helps avoid dirt, dust, and other impurities that can negatively affect indoor air quality. A tight building envelope is a critical component to ensure good indoor air quality.

Increased construction quality. Building codes establish the legal minimum construction standards. ENERGY STAR labeled homes are constructed to significantly exceed these codes. Figure 2 shows that to increase insulation levels, builders must install an insulation material with a higher R-value or increase the thickness of the building envelope component. In either case, the result is better quality construction. This is particularly true in cases where special care is taken during installation to insure no gaps or voids are left in the insulation.

Reduced obsolescence. Based on recent trends for improved efficiency, building envelopes with increased insulation levels are expected to become industry practice. Since it is both difficult and costly to increase insulation after a house is built, it is best to increase insulation levels during the original construction. ENERGY STAR labeled homes are constructed to exceed minimum building codes requirements are, therefore, expected to be less vulnerable to obsolescence.

Lower utility bills. More than 40 percent of the energy consumed in a typical household goes to heating and cooling. Increased insulation reduces this energy consumption which lower energy consumption results in lower utility bills.

Improved resale position. Increased insulation levels can provide the many impressive benefits listed above resulting in a more comfortable, higher quality home with better indoor air quality and lower utility bills. These benefits can translate into higher resale value.

FIGURE 2: R-VALUES FOR VARIOUS INSULATION MATERIALS

Insulation Material	R-value per inch of Thickness
Batt-type	3.1 to 3.5
Loose fill	2.9 to 3.7
Board stock	3.5 to 6.2
Spray-type	3.5 to 6.0